⑦ pg 628 text

H_0: The distribution of ethnicities in the NYC police department represents (or is the same) as the distribution of ethnicities of the youth in NYC.

H_A: The distribution of ethnicities in the NYC police department does not represent the distribution of ethnicities of the youth in NYC.

To conduct a χ^2-test of Goodness of Fit, we need to meet the Counted Data Condition, the Independence Assumption & the ~~Expected Cell Frequency Co~~ Simple Size Assumption.
The Counted Data Condition is satisfied because we can convert the percentages to counts. We can meet the Independence Assumption by satisfying the
Randomization Condition: We will assume that the current police ethnicity distribution is representative of recent departments
To satisfy the Simple Size Assumption, we can satisfy the Expected Cell Frequency Condition: The expected counts are all greater than 5

Since we have meet all the Assumptions/Conditions → we can conduct a χ^2 test of Goodness of Fit with 4 degrees of freedom ($n-1 = 5-1 = 4$)

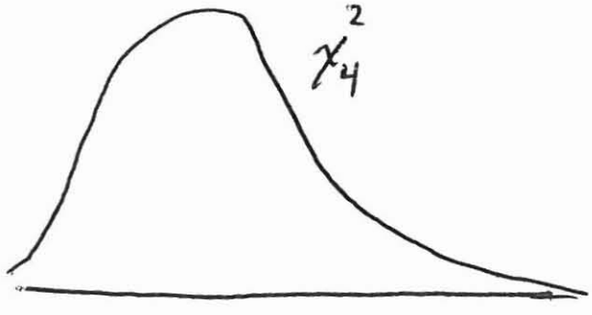
Police Department

ex: 26181 · .648 ← round to whole #

26181 · .292

Ethnicity	Observed	Expected
White	16965	7644.852
Black	3796	7383.042
Latino	5001	8247.015
Asian	367	2382.471
Other	52	523.620
	26,181	

$$\chi^2 = \sum \frac{(\text{Observed} + \text{Expected})^2}{\text{Expected}} = \frac{(16965 - 7644.582)^2}{7644.582} + \ldots + \frac{(52 - 523.620)^2}{523.620}$$



$= 16512$

$=$

P-value $= p(\chi^2 > 16512) = 0$

Reject H_0

(17)

H_0: Political party is independent of gender in Montana

H_A: Political party is not independent of gender in Montana

To perform a χ^2 Test for Independence I need to meet the Counted Data Condition, Independence Assumption & the Sample Size Assumption. To meet the Counted Data Condition, I will look at the data & yes it is counted data. To meet the Independence Assumption, I will satisfy the ~~Independence Assumption~~

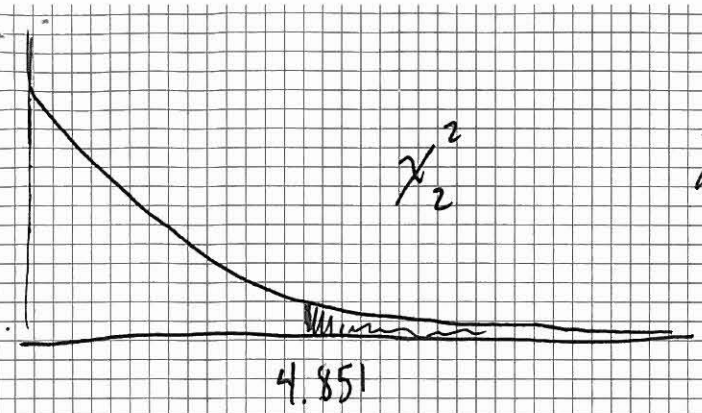
Randomization Condition: We can assume that the survey was conducted randomly.

To meet the Sample Size Assumption, I will satisfy the Expected Cell Frequency Condition: The expected counts are all greater than 5.

Since I have meet all the Assumptions/Conditions I will be perform a χ^2 Test for Independence.

	Democrats	Republicans	Independent
Male	36 / 43.663	45 / 40.545	24 / 20.792
Female	48 / 40.337	33 / 37.455	16 / 19.208

observed / expected



$$\chi^2_2 = \sum \frac{(obs - exp)^2}{exp} =$$

$$= \frac{(36 - 43.663)^2}{43.663} + \ldots + \frac{(16 - 19.208)^2}{19.208}$$

$$= \text{[redacted]} = 4.851$$

$$\text{P-value} = p(\chi^2 > 4.851)$$

$$= .088$$

A P-value of .088 is greater than our alpha level of .05 and as a result is large enough to fail to reject the null. If the null is true, we would get results like this approximately 88 times out of Thousand samples. Our results are not statistically significant.

20) χ^2 test for ~~Independence~~ Homogeneity

H_0: The distribution of attitudes about the ideal family was the same in 1991 and 2001

H_A: The distribution of attitudes about the ideal family was not the same in 1991 and 2001.

To perform a χ^2 Test for Homogeneity I need to satisfy the Counted Data Condition, the Independence Assumption & the Sample Size Assumption. To meet the Counted Data Condition, I will look at the data & which is counted. To meet the Independence Assumption, I will satisfy the

Randomization Condition: The adults were randomly selected.

To meet the Sample Size Assumption, I will satisfy the

Expected Cell Frequency Condition: All the expected values are greater than 5

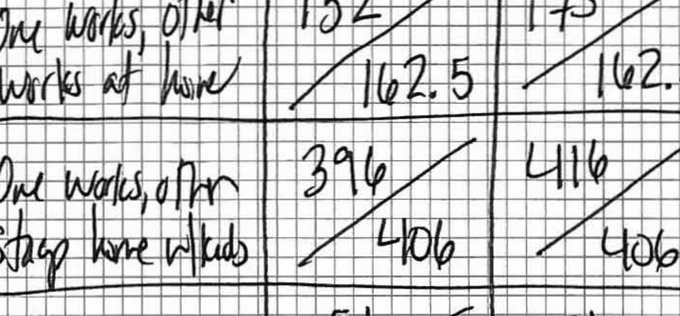
Since all the Assumptions / Conditions have been meet, we can use conduct a χ^2 Test for Homogeneity with 4 degrees of freedom $[(3-1)(2-1) = 4]$

	1991	2001
Both work Full Time	142 / 136.5	131 / 136.5
One works full time, other part time	274 / 259	244 / 259
One works, other works at home	152 / 162.5	173 / 162.5
One works, other stays home w/kids	396 / 406	416 / 406
No opinion	51 / 51	51 / 51

Key: observed / expected

Use χ^2-Test
- Input Observed values in matrix A
- Expected values will be displayed in matrix B

$$\chi^2_4 = \Sigma \frac{(obs-exp)^2}{exp} = \frac{(142-136.5)^2}{136.5} + \frac{(274-259)^2}{259} + \dots + \frac{(51-51)^2}{51} = 4.03$$



4.03

$$P\text{-value} = p(\chi^2_4 > 4.03) = .402$$

The P-value is large enough that I fail to reject the null hypothesis. If the null was true, we would expect results ~~similar~~ like this about 402 times out of 1000 samples. The results are not statistically significant and there is evidence that the attitudes about the ideal family are the same in 1991 as 2001.
The same in 1991 and 2001.